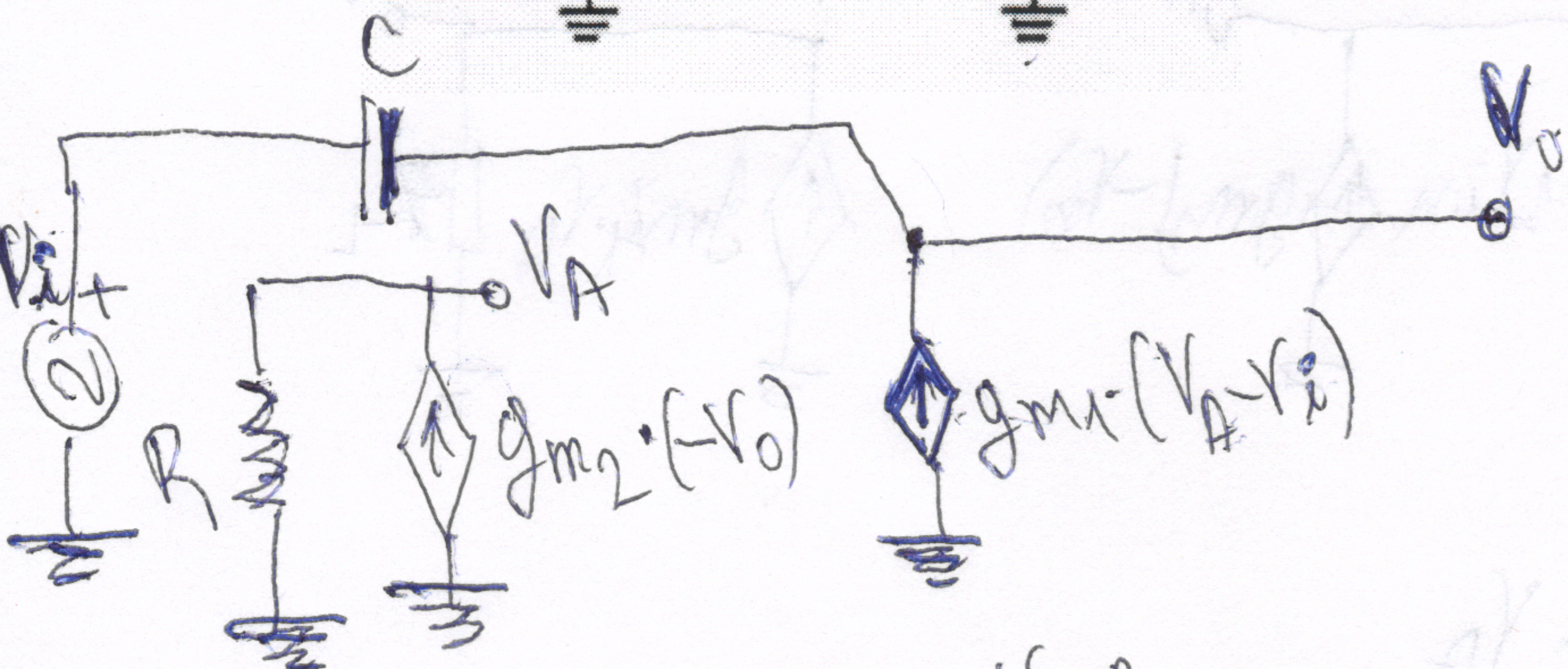
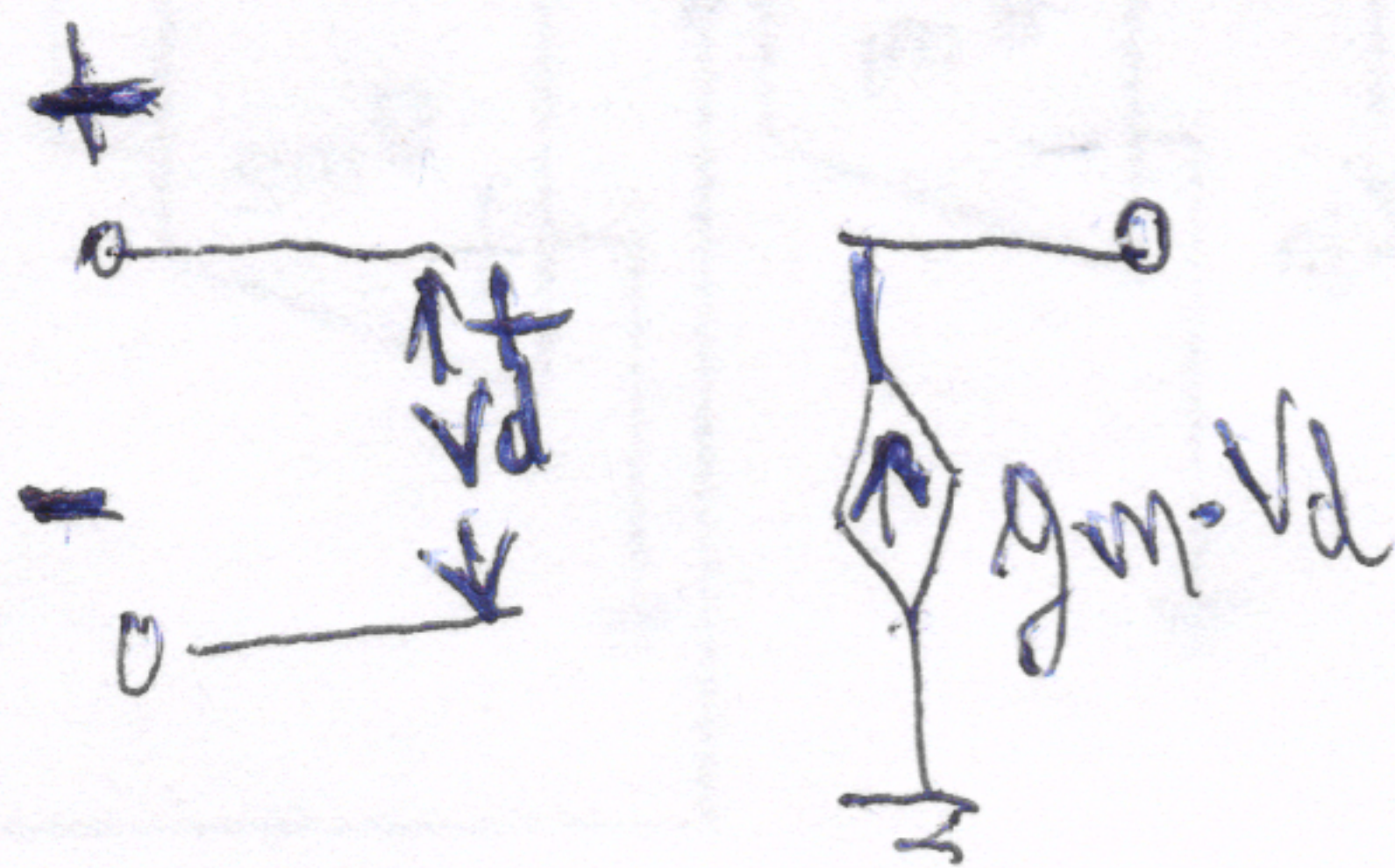
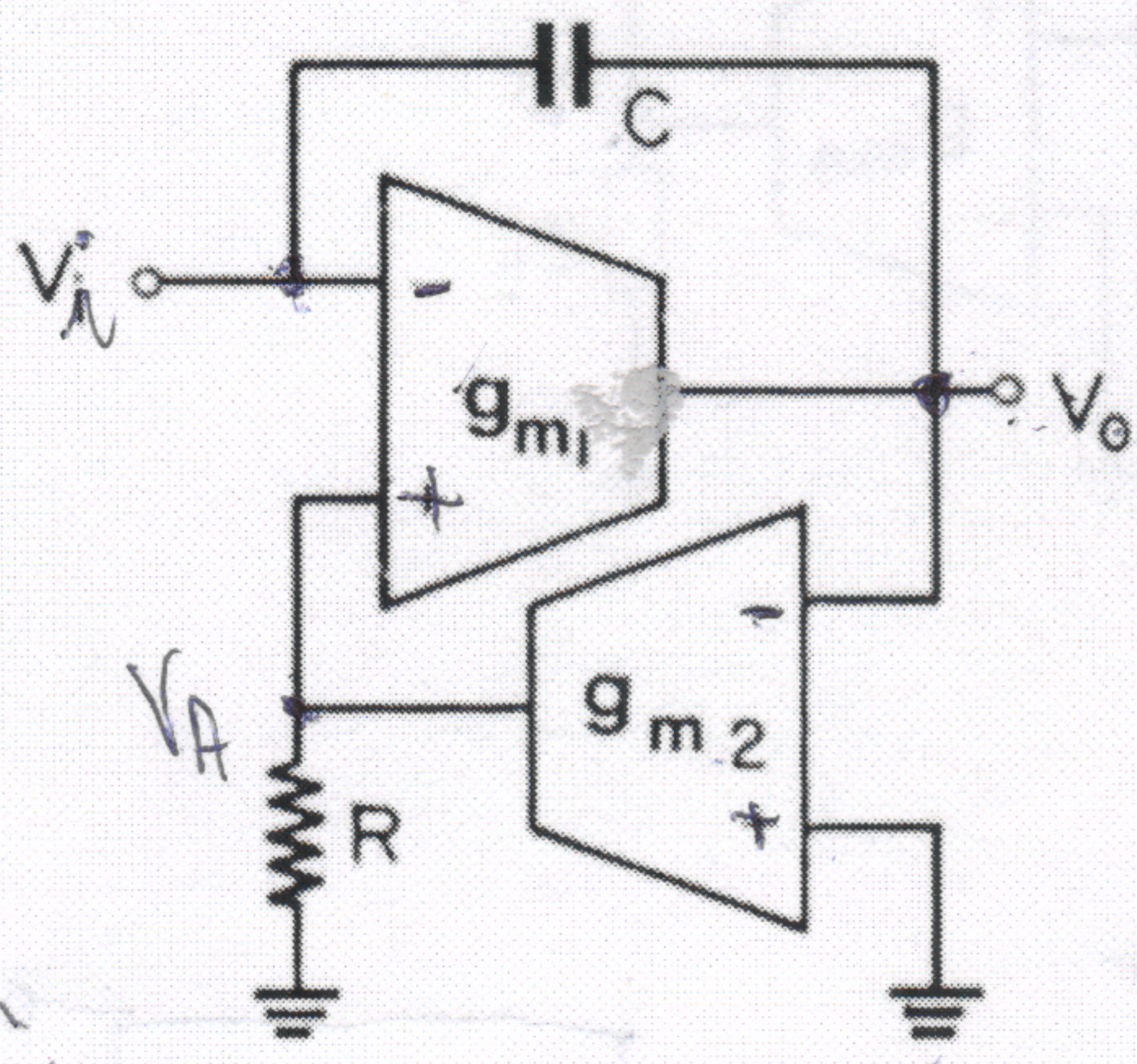


- 1) Odrediti prenosnu funkciju kola sa slike i funkciju koje ono obavlja kada je $g_{m2} \cdot R = 1$.



$$V_A = -g_{m2} \cdot V_o R$$

$$V_o = V_i + \frac{1}{sC} \cdot g_{m1}(V_A - V_i)$$

$$V_o = V_i + \frac{1}{sC} \cdot g_{m1}(-g_{m2}V_o R - V_i)$$

$$V_o \left(1 + \frac{1}{sC} g_{m1} g_{m2} R\right) = V_i + \frac{1}{sC} g_{m1}(-1) \cdot V_i$$

$$H(s) = \frac{V_o}{V_i} = \frac{1 + \frac{1}{sC} g_{m1}(-1)}{1 + \frac{1}{sC} g_{m1} g_{m2} R} = \frac{sC - g_{m1}}{sC + g_{m1} g_{m2} R}$$

$$|H(j\omega)| = 1$$

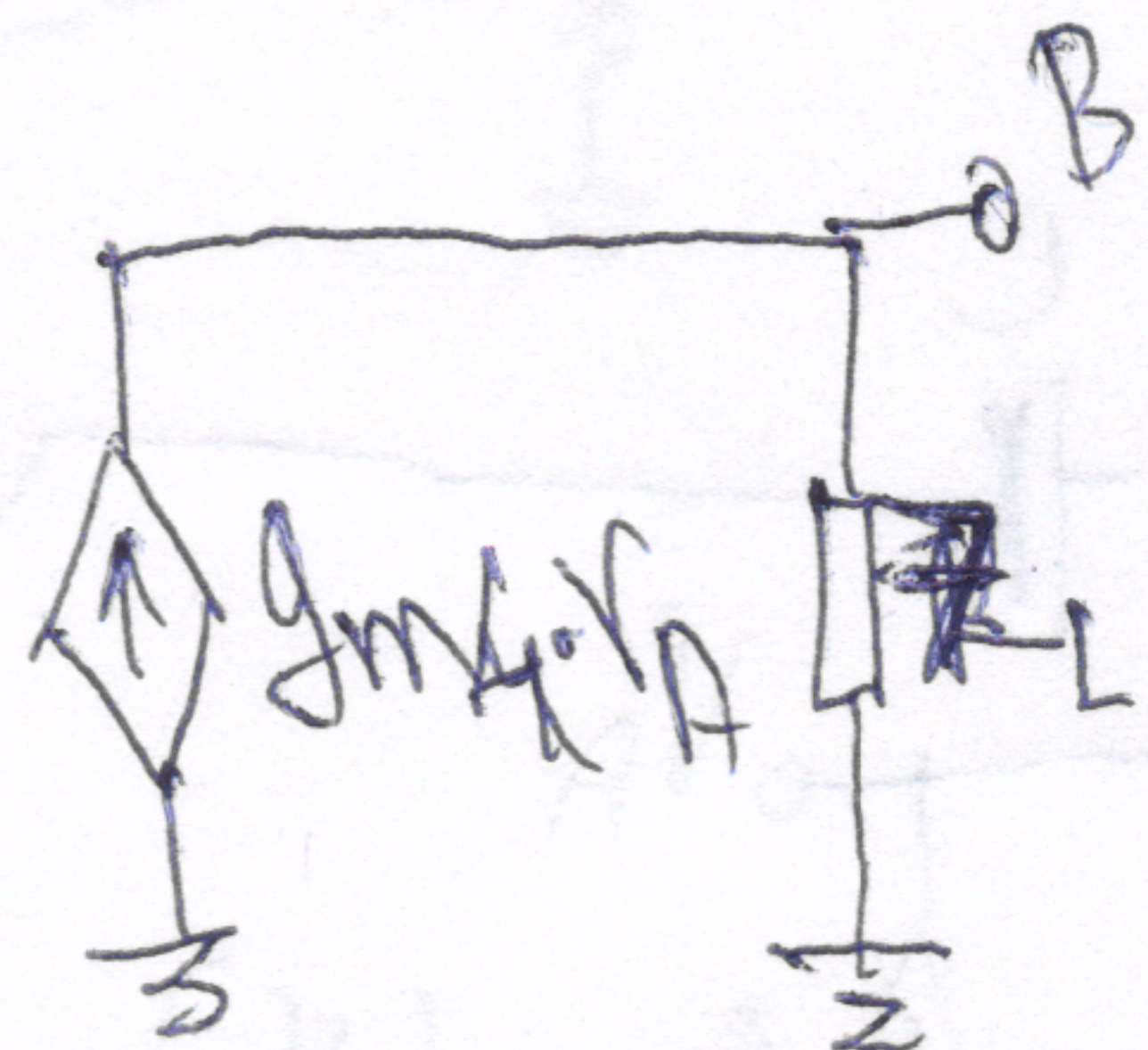
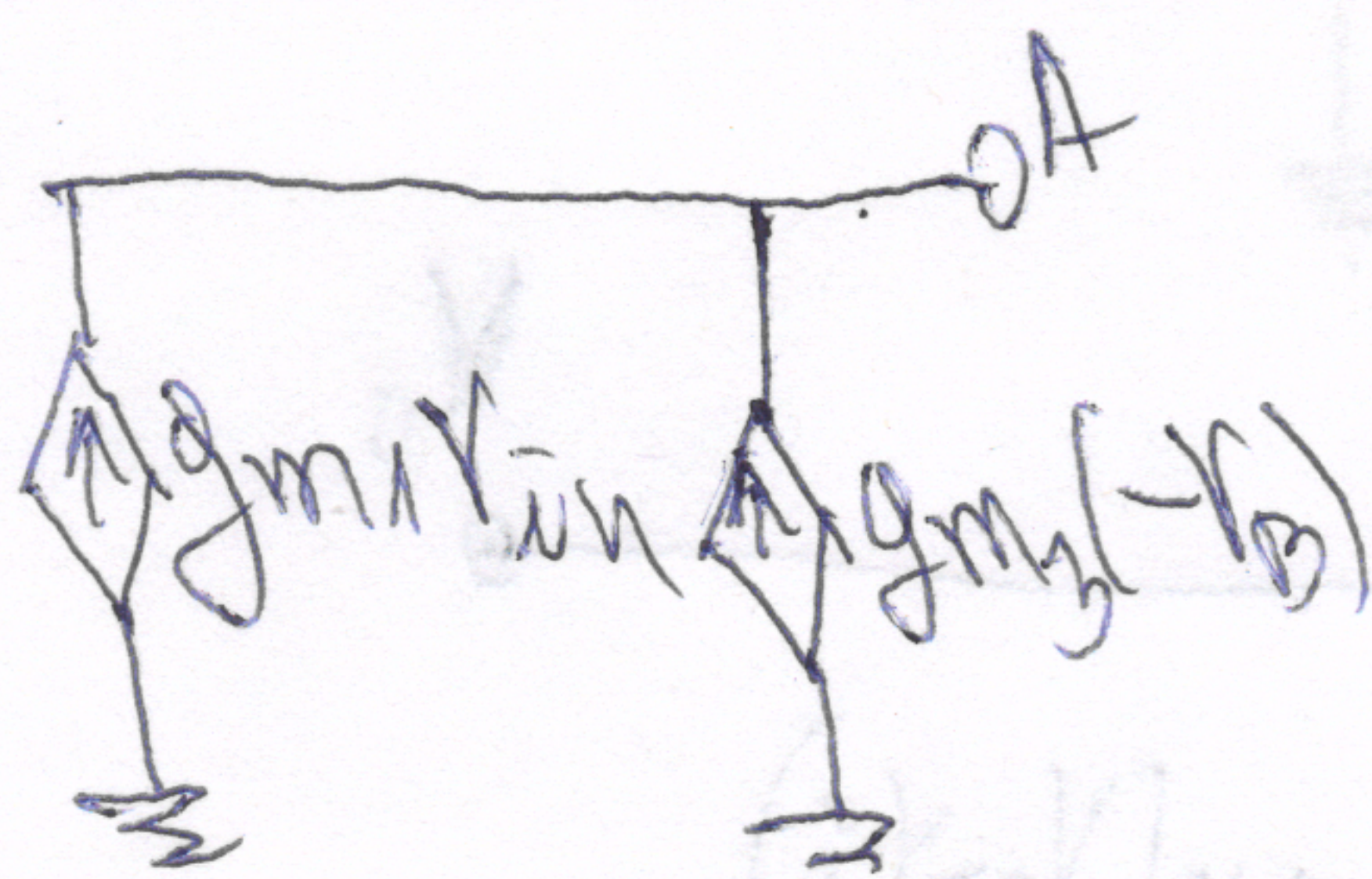
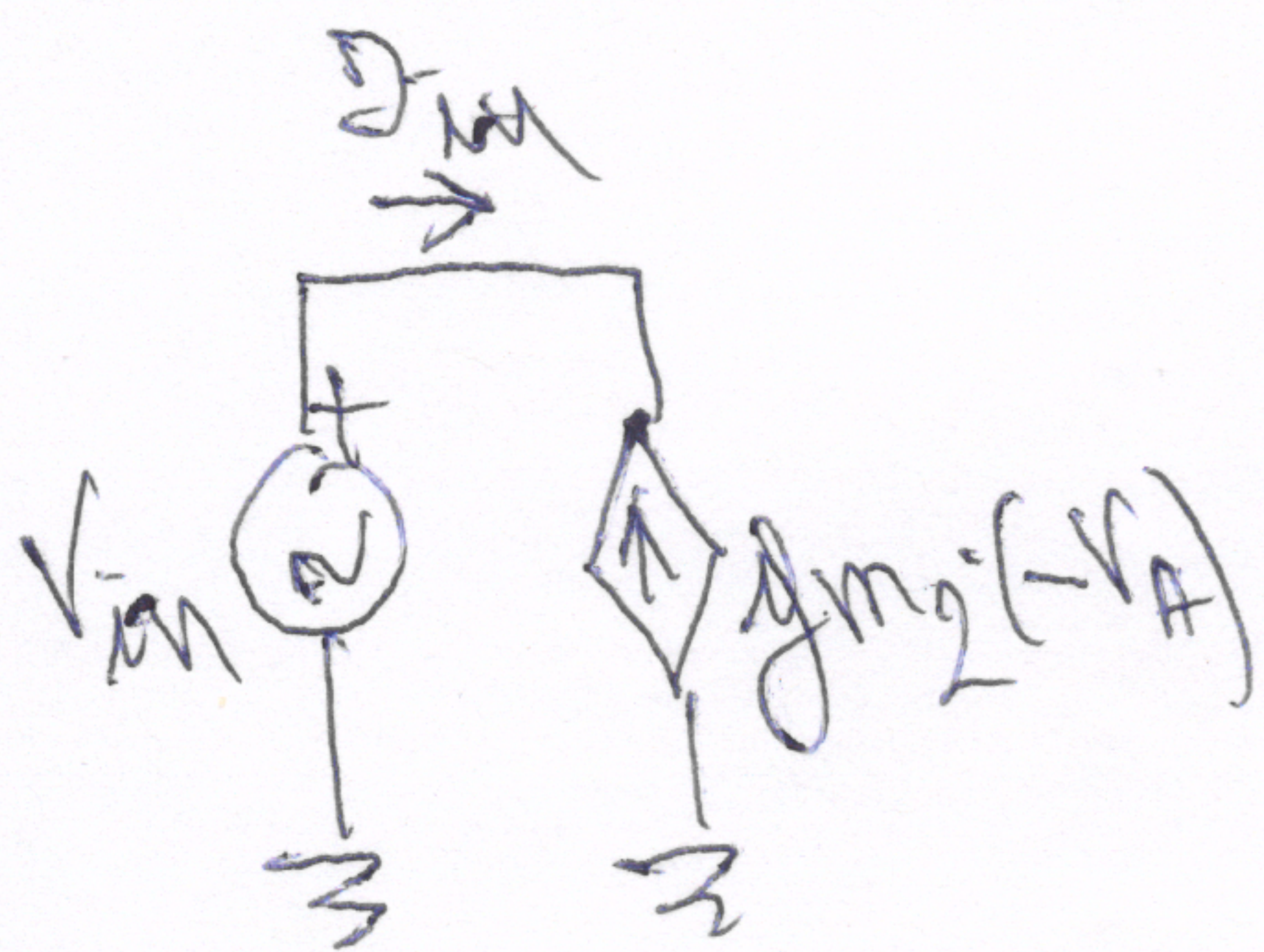
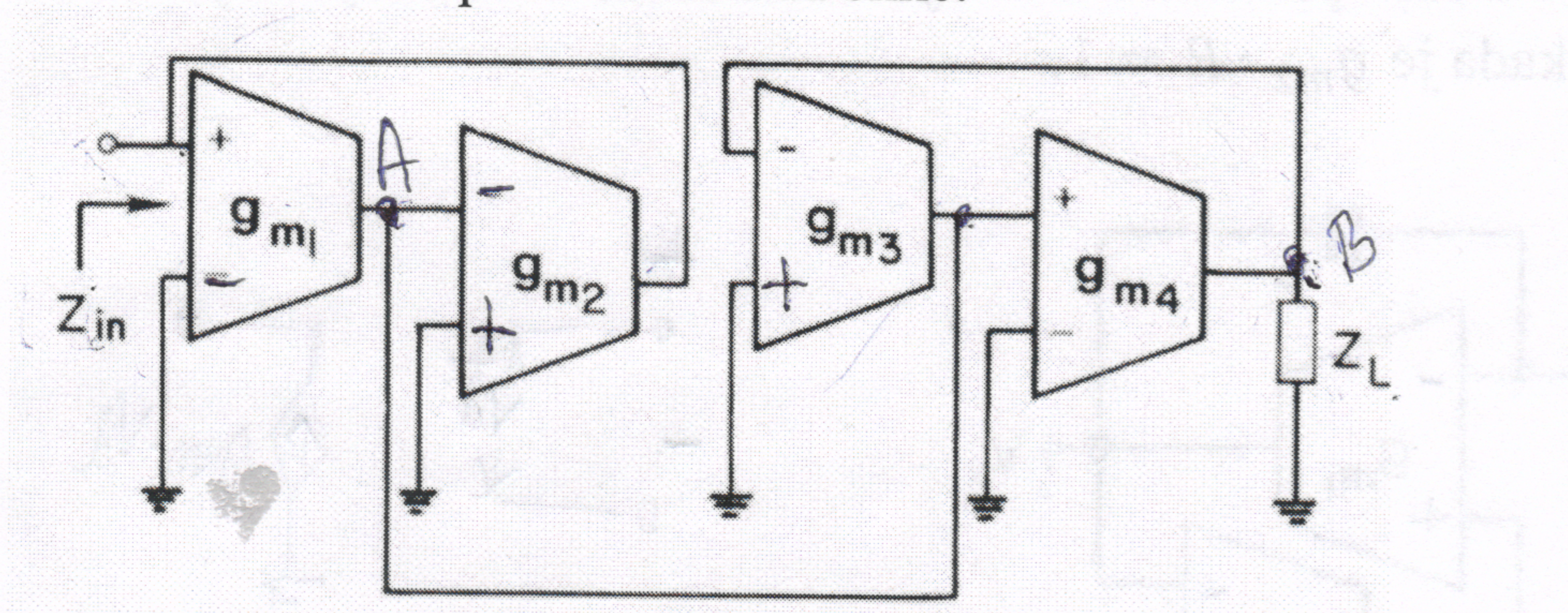
$$\arg\{H(j\omega)\} = -2 \arctan \frac{\omega}{\omega_1}$$

Ово коло представља фазни коректор

$$H(s) = \frac{sC - g_{m1}}{sC + g_{m1}}$$

$$H(s) = \frac{\frac{sC}{g_{m1}} - 1}{\frac{sC}{g_{m1}} + 1} = \frac{j\omega - \omega_1}{1 + j\omega/\omega_1}$$

2) Odrediti ulaznu impedansu kola sa slike.



$$V_B = Z_L \cdot g_{m4} \cdot V_A$$

$$g_{m1} \cdot V_{in} - g_{m3} \cdot V_B = 0$$

$$I_{in} = g_{m2} \cdot V_A$$

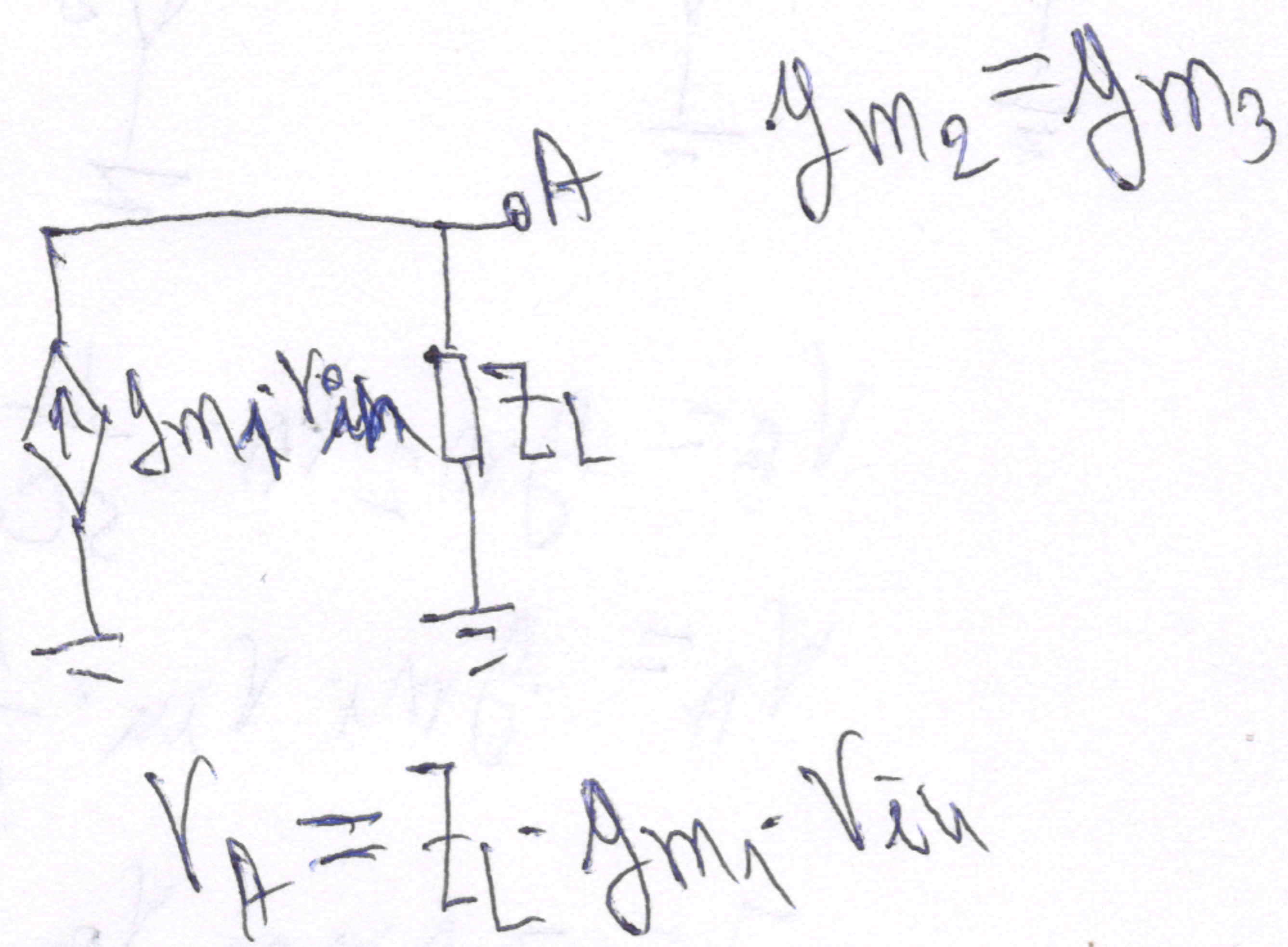
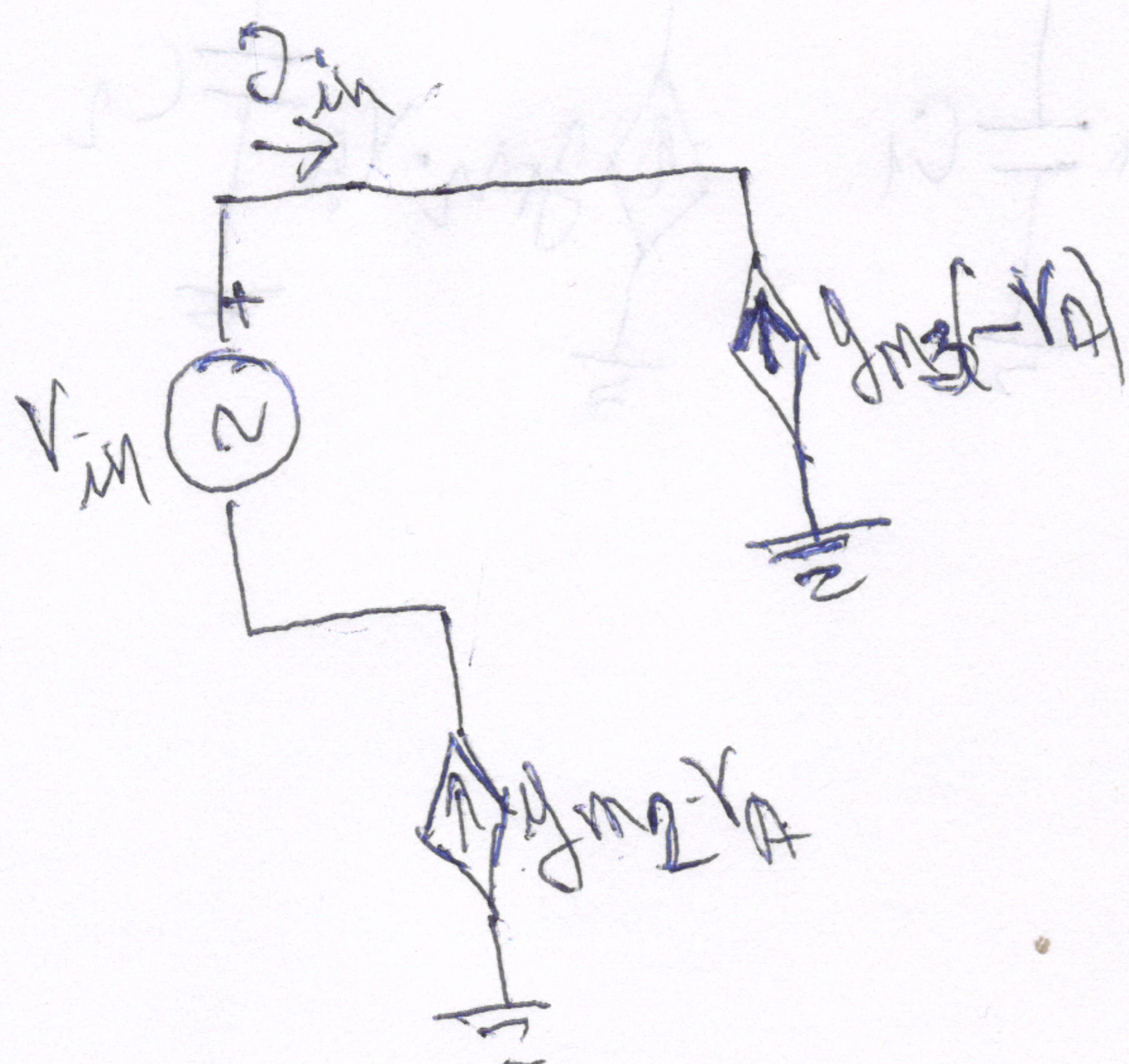
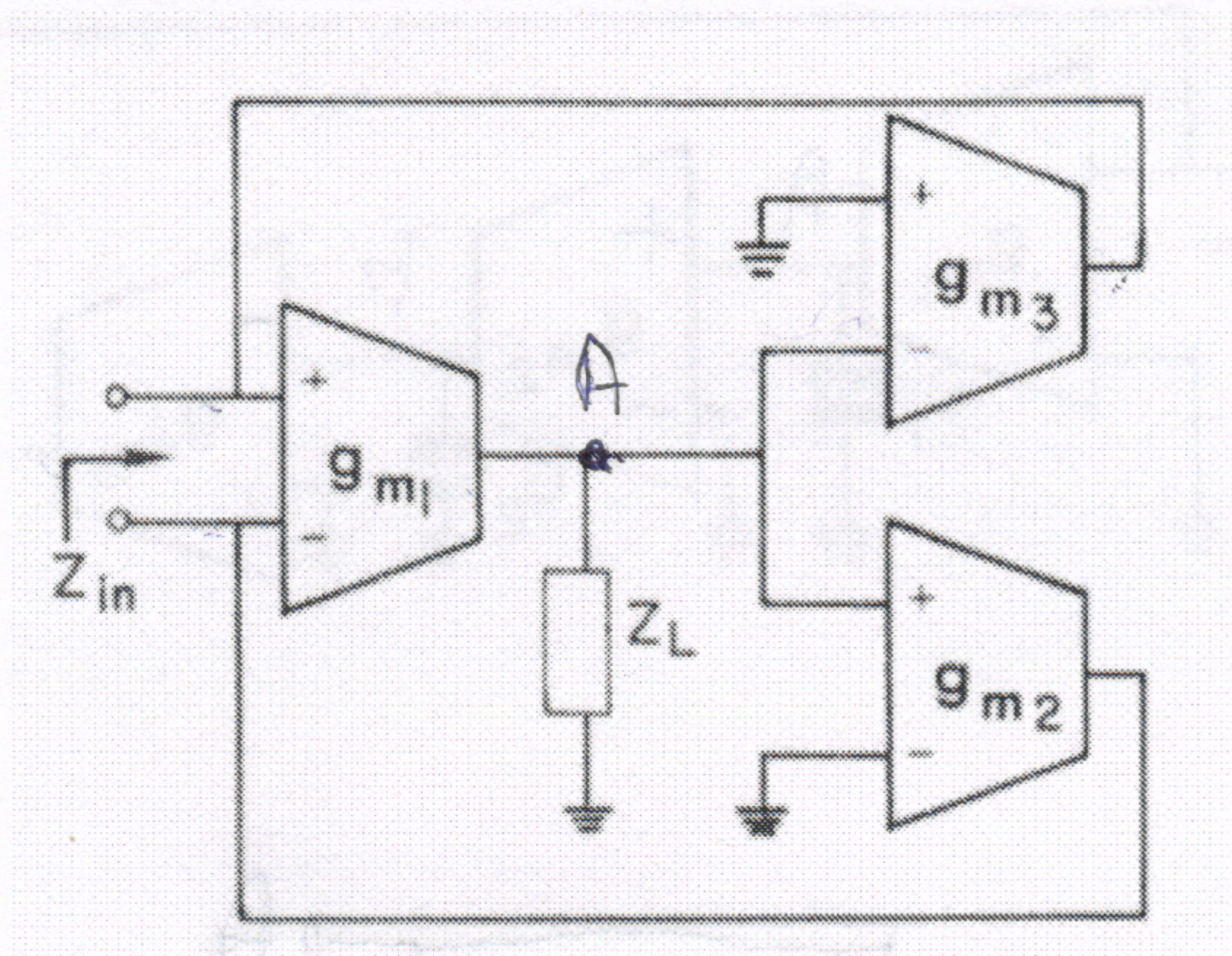
$$g_{m1} \cdot V_{in} - g_{m3} \cdot g_{m4} \cdot Z_L \cdot V_A = 0$$

$$V_A = \frac{V_{in} g_{m1}}{g_{m3} - g_{m4} Z_L}$$

$$I_{in} = g_{m2} \cdot \frac{V_{in} g_{m1}}{g_{m3} - g_{m4} Z_L}$$

$$Z_{in} = \frac{V_{in}}{I_{in}} = \frac{g_{m3} - g_{m4} Z_L}{g_{m1} \cdot g_{m2}}$$

- 3) Na slici je prikazan konvertor impedanse. Odrediti analitički izraz za izlaznu impedansu ukoliko je opterećenje Z_L kondenzator kapacitivnosti C_L .



$$V_A = Z_L \cdot g_{m1} \cdot V_{in}$$

$$I_{in} = g_{m2} \cdot V_A$$

$$I_{in} = g_{m2} \cdot g_{m1} \cdot Z_L \cdot V_{in}$$

$$Z_{in} = \frac{V_{in}}{I_{in}} = \frac{1}{g_{m1} g_{m2} Z_L}$$

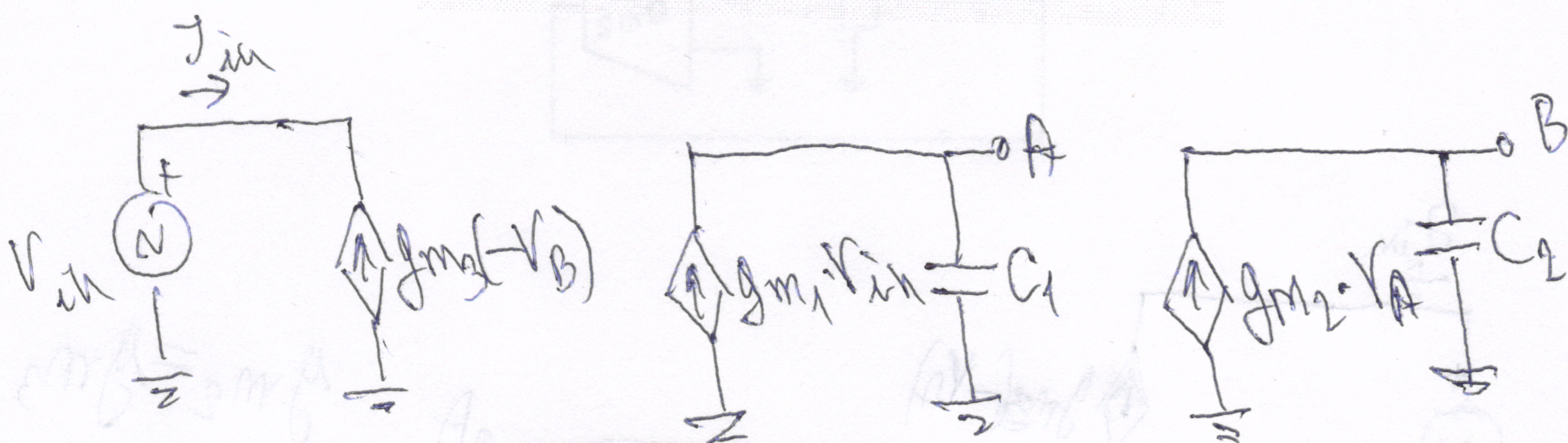
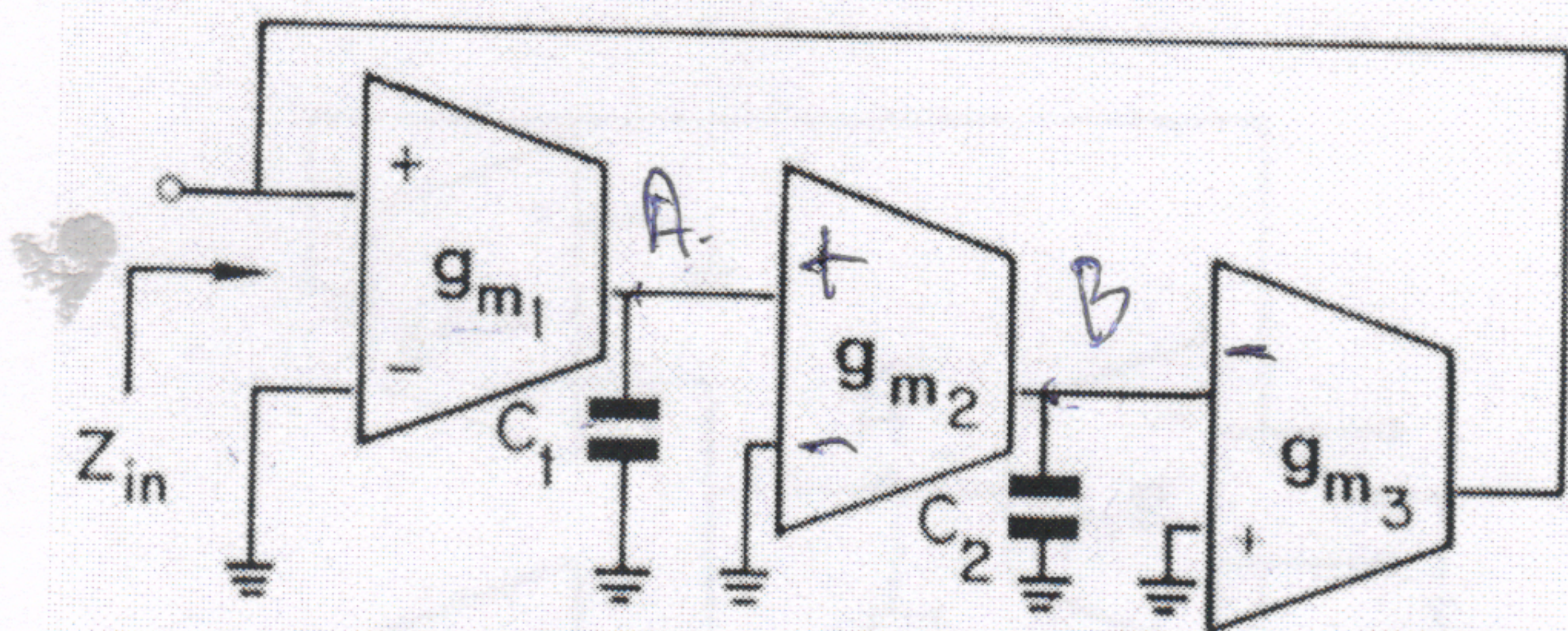
$$Z_L = \frac{1}{j\omega C_L}$$

$$Z_{in} = \frac{1}{g_{m1} g_{m2}} \cdot j\omega C_L$$

$$L_{eq} = \frac{C_L}{g_{m1} g_{m2}}$$

4) Dokazati da se kolom sa slike realizuje superinduktivnost

$$Z = -L \cdot \omega^2$$



$$V_B = g_{m2} \cdot V_A \cdot \frac{1}{sC_2}$$

$$V_A = g_{m1} \cdot V_{in} \cdot \frac{1}{sC_1}$$

$$I_{in} = g_{m3} \cdot V_B$$

$$V_B = g_{m2} \cdot \frac{1}{sC_2} \cdot g_{m1} \cdot \frac{1}{sC_1} \cdot V_{in}$$

$$I_{in} = g_{m3} \cdot g_{m2} \cdot g_{m1} \cdot \frac{1}{sC_1} \cdot \frac{1}{sC_2} \cdot V_{in}$$

$$Z_{in} = \frac{V_{in}}{I_{in}} = \frac{sC_1 \cdot sC_2}{g_{m1} g_{m2} g_{m3}}$$

$$Z_{in} = -L \cdot \omega^2$$

$$L = \frac{C_1 C_2}{g_{m1} g_{m2} g_{m3}}$$